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(54) **Additive composition**

(57) A release additive composition including at least one overbased detergent present in a form chosen from a solid and a semi-solid is disclosed. Also disclosed is a

lubrication system and a method of improving the drain interval of oil.

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DescriptionField of the Disclosure

[0001] The present disclosure relates to a release additive composition comprising at least one overbased detergent present in a form chosen from a solid and a semi-solid.

Background of the Disclosure

[0002] During the combustion process in internal combustion engines, mineral and organic acidic by-products are produced. Concurrently, other acidic products can be generated by the degradation of lubricants used in internal combustion engines. Such by-products lead to the formation of high temperature deposits, low temperature sludge formation and corrosion of various engine parts which ultimately leads to increased wear of lubricated engine components. Basic substances are typically added to lubricants to neutralize the acidic products in order to break the cycle of sludge and high temperature deposit formation and accelerated wear of engine parts.

[0003] Overbased detergents are generally salts or complexes having a large excess of base over that required to neutralize the oil-soluble anionic component of the detergent. Overbased detergents are basic compounds which have been added to lubricant compositions to neutralize acidic degradation products and therefore maintain oil basicity. However, the ability to retain the basicity of the lubricant composition throughout its life is a problem. Failure to maintain oil's basicity can dramatically increase a vehicle's downtime, for example by requiring more frequent oil changes than the recommended 20,000 or 30,000 miles, or dramatically shorten an engine's life.

[0004] In summary, the ability to retain the basicity in a lubricant composition can, for example, dramatically reduce the risk of sludge and high temperature deposit formation and corrosion plus reduce maintenance time-, and extend engine life.

SUMMARY OF THE DISCLOSURE

[0005] In accordance with the disclosure, there is provided a release additive composition comprising at least one overbased detergent present in a form chosen from a solid and a semi-solid; a lubricant composition including a major amount of a base oil, and a minor amount of a release additive composition comprising at least one overbased detergent present in a form chosen from a solid and a semi-solid; and optionally a method for improving the drain interval of engine oil comprising adding to a lubrication system a release additive composition comprising at least one overbased detergent present in a form chosen from a solid and a semi-solid.

[0006] Additional objects and advantages of the disclosure will be set forth in part in the description which follows, and can be learned by practice of the disclosure. The objects and advantages of the disclosure will be realized and attained by means of the elements and combinations particularly pointed out in the appended claims.

[0007] It is to be understood that both the foregoing general description and the following detailed description are exemplary and explanatory only and are not restrictive of the disclosure, as claimed.

DESCRIPTION OF THE EMBODIMENTS

[0008] The engines that can use the release additive composition include, but are not limited to internal combustion engines, stationary engines, generators, diesel and/or gasoline engines, on highway and/or off highway engines, two-cycle engines, aviation engines, piston engines, marine engines, railroad engines, biodegradable fuel engines and the like. In one embodiment, the engine can be equipped with after-treatment devices, such as exhaust gas recirculation systems, catalytic converters, diesel particulate filters, NO_x traps, and the like.

[0009] In accordance with the present disclosure, the basicity of a lubricating oil can be maintained by using the release additive composition thereby effecting at least one of the following properties: reducing the risk of corrosion, reducing the maintenance time on a vehicle, and extending the engine life. Moreover, the basicity of the lubricating composition can be increased by contact with the release additive composition. It is believed, without being limited to any particular theory, that the use of the disclosed release additive composition can achieve at least one of the above disclosed properties because the disclosed overbased detergent will be slowly released into the lubricating composition thereby retaining the TBN of the lubricating composition over the life of the lubricating composition. One of ordinary skill in the art would understand that the life of the lubricating composition is dependent upon several factors including, but not limited to, engine operation, engine type, engine service, mileage of the vehicle, quality of the base oil in the lubricating composition, etc.

[0010] The term "release" as used herein is understood to mean that the components of the additive composition are released over an extended period of time, e.g., over the life of the lubricating composition. The release rate can be

moderated by several factors, such as, the location of the additive composition in the lubrication system, the additive composition formulation, the form of the composition, and/or the mode of addition of the additive composition into a lubricating composition. One of ordinary skill in the art can modify any and/or all of the above factors in order to obtain the desired release rate of the additive composition.

[0011] The release additive composition can be located anywhere within a lubrication system so long as the additive composition will be in contact with a lubricating composition. For example, the release additive composition can be located in at least one of a filter, drain pan, oil bypass loop, canister, housing, reservoir, pockets of a filter, canister in a filter, mesh in a filter, canister in a bypass system, mesh in a bypass system, and the like. In an embodiment, the lubrication system can comprise an oil filter. The oil filter can comprise the release additive composition disclosed herein.

[0012] In another embodiment, the oil filter can comprise a housing, such as a sleeve or cup, that can be partitioned, for example with a non-diffusible barrier, thereby creating at least one pocket. Each pocket can comprise an identical, similar and/or a different release additive composition wherein the composition can be in an identical, similar and/or different form, such as a semi-solid or solid form. A non-limiting example of this concept includes one pocket comprising a release additive composition comprising an overbased detergent in a solid form and an antioxidant in a semi-solid form. The filter can be a desirable location to place the release additive composition because the additive composition and/or spent additive composition can easily be removed and then replaced with a new and/or recycled additive composition.

[0013] In yet another embodiment, the release additive can be located anywhere within the lubrication system. For example, the release additive can be located outside of an oil filter on the "dirty" side or it can be located outside of the oil filter on the "clean" side. One of ordinary skill in the art would understand that the location of the release additive in the lubrication system is not critical so long as the release additive composition is in contact with a lubricating composition.

[0014] Moreover, the release rate of the release additive formulation can be moderated by the formulation and/or the form of the additive composition. For example, the release additive composition can comprise at least one component that selectively dissolves completely or that is poorly oil-soluble and thus remains till the end of its service life, or combinations thereof. Further, the additive composition can be in the form of a semi-solid, solid, or combinations thereof. Non-limiting examples include an oil filter comprising an overbased detergent in a semi-solid form, an oil filter comprising an overbased detergent in a solid form and an antioxidant in a semi-solid form, and an oil filter comprising a viscosity index improver in a semi-solid form and an overbased detergent in a solid form. A "semi-solid" form as used herein is understood to mean one component having rigidity and viscosity intermediate between a solid and a liquid, for example the one component is not a liquid or free flowing at room temperature (23°C), for example, water is considered a free flowing liquid at room temperature.

[0015] Moreover, the release rate of the additive composition can be controlled by varying the degree of solidity of the composition. For example, a semi-solid additive composition can have a faster release rate into a lubricating composition as compared to a solid additive composition. One of ordinary skill in the art can select the form of the additive composition based upon the desired release rate.

[0016] The release additive composition can be added to the lubrication system by any known method depending on the desired form of the additive composition, the desired speed of addition, the desired release rate, the desired mode of operation and/or any of the combinations of the above. In an embodiment, the additive composition can be a semi-solid and can be added to the lubrication system by means of an injector pump, or a container in an oil filter. In another embodiment, the additive composition can be a solid and can be introduced into the lubricating oil system by means of an auger. It is contemplated that the release additive composition can be released into a lubricating composition slowly over a long period of time, such as the life of the lubricating composition, or quickly over a short period of time, but remain in the lubricating composition over the life of the lubricating composition.

[0017] The release additive composition can be present in the lubricating composition in any effective amount so long as the TBN of the lubricating composition is maintained or increased over the life of the lubricating composition. In an embodiment, the TBN of the lubricating composition can be maintained by adding the disclosed release additive composition to a lubricating composition. In another embodiment, the TBN of the lubricating composition can be increased by adding the disclosed release additive composition to a lubricating composition. By maintaining or increasing the TBN of the lubricating composition, it is believed that the engine oil drain interval can be extended beyond current manufacturer's recommendations. In an embodiment, for a passenger car, the engine oil drain interval can be extended beyond about 7,500 miles, such as beyond about 10,000 miles for normal service. In another embodiment, for a truck in a trucking fleet, the engine oil drain interval can be extended beyond about 15,000 miles, for example about 25,000, and as a further example beyond about 35,000 miles for normal fleet service.

[0018] A lubricating composition can comprise a minor amount of the release additive composition. A "minor amount" as used herein is understood to mean less than about 50%, such as for example less than about 40%, and as a further example from less than about 30% by weight relative to the total weight in the lubricating composition.

[0019] In embodiments, the lubricating composition can also comprise a major amount of a base oil. The base oil can

be selected from, for example, natural oils such as mineral oils, vegetable oils, paraffinic oils, naphthenic oils, aromatic oils, synthetic oils, derivatives thereof, and mixtures thereof. The synthetic oils can comprise at least one of an oligomer of an alpha-olefin, an ester, an oil derived from a Fischer-Tropsch process, and a gas-to-liquid stock. A "major amount" can be understood to mean greater than or equal to about 50%.

[0020] In accordance with the present disclosure, a release additive composition can comprise at least one overbased detergent. The at least one overbased detergent can be in any form, such as a semi-solid, solid, or combinations thereof. If the release additive composition comprises other additives, such as an antioxidant or a non-dispersant viscosity index improver, then each additive present in the release additive composition can be in a different form. For example, the release additive composition can comprise an overbased detergent in the form of a semi-solid and an antioxidant in the form of a solid. Any and all variations and combinations of additives and forms are contemplated within the scope of the disclosure.

[0021] As used herein, the "overbased detergent" is understood to mean a detergent chosen from overbased sulfonates, phenates, salicylates, carboxylates, and the like with a non-dispersant viscosity index improver. In an embodiment, the viscosity index improver can be an olefin copolymer. In another embodiment, the viscosity index improver can be grafted with maleic anhydride or other suitable carboxylic reagent known to those skilled in the art.

[0022] The overbased detergent can include, but is not limited to, overbased calcium sulfonate detergents which are commercially-available, overbased detergents containing metals such as Mg, Ba, Sr, Na, Ca, and K, and mixtures thereof. The detergents can be used alone or in combination. These commercially-available products can be formed by reacting carbon dioxide with mixtures of lime (calcium hydroxide) and an alkyl benzene sulfonate soap to form calcium carbonate-containing micelles. More than an equivalent amount of lime and carbon dioxide can be used so that the product detergent becomes basic in character.

[0023] Such materials can be conveniently described in terms of the total base number ("TBN"), which is a measure of the base capacity of the product. Overbased detergents with TBN's ranging from about 10 to about 600, for example from about 100 to about 500, and as a further example from about 200 to about 400. Where mixtures of overbased detergents are used, at least one should have a TBN value of at least 100.

[0024] In an embodiment, the overbased detergent can comprise a functionalized olefin polymer, for example, the detergent can comprise a grafted olefin copolymer. The terms "polymer" and "copolymer" are used interchangeably herein. The functionalized olefin polymers used in one embodiment of the present disclosure can be grafted, olefin copolymers comprising a grafted copolymer prepared from ethylene and at least one C₃ to C₂₃ alpha-monoolefin and, optionally, a polyene; wherein the copolymer of ethylene and at least one C₃ to C₂₃ alpha-monoolefin has grafted thereon at least one carboxylic acid group, such as maleic anhydride. The olefin copolymer useful in the present disclosure can in one embodiment have a number average molecular weight from about 5,000 to about 150,000. The functionalized olefin copolymers useful herein are fully described in U.S. Pat. Nos. 5,075,383; 5,139,688; 5,238,588 and 6,107,257, which are herein incorporated by reference in their entirety. In an embodiment, the functionalized olefin polymer is a non-dispersant.

[0025] The overbased detergent can be present in the additive composition in any effective amount, such as from about 0% to about 100 wt. %, for example from about 10% to about 90 wt. %, and as a further example from about 20% to about 80 wt. % relative to the total weight of the release additive composition.

[0026] The release additive composition can further comprise an antioxidant. Suitable antioxidants for use herein include, but are not limited to alkyl-substituted phenols such as 2,6-di-tertiary butyl-4-methyl phenol, phenate sulfides, phosphosulfurized terpenes, sulfurized esters, aromatic amines, diphenyl amines, alkylated diphenyl amines, hindered phenols, and mixtures thereof.

[0027] The antioxidant can be an amine, such as bis-nonylated diphenylamine, nonyl diphenylamine, octyl diphenylamine, bis-octylated diphenylamine, bis-decylated diphenylamine, decyl diphenylamine, and mixtures thereof.

[0028] The antioxidant can be a sterically hindered phenol, such as 2,6-di-tert-butylphenol, 4-methyl-2,6-di-tert-butylphenol, 4-ethyl-2,6-di-tert-butylphenol, 4-propyl-2,6-di-tert-butylphenol, 4-butyl-2,6-di-tert-butylphenol, 2,6-di-tert-butylphenol, 4-pentyl-2,6-di-tert-butylphenol, 4-hexyl-2,6-di-tert-butylphenol, 4-heptyl-2,6-di-tert-butylphenol, 4-(2-ethyl-hexyl)-2,6-di-tert-butylphenol, 4-octyl-2,6-di-tert-butylphenol, 4-nonyl-2,6-di-tert-butylphenol, 4-decyl-2,6-di-tert-butylphenol, 4-undecyl-2,6-di-tert-butylphenol, 4-dodecyl-2,6-di-tert-butylphenol, 4-tridecyl-2,6-di-tert-butylphenol, 4-tetradecyl-2,6-di-tert-butylphenol, methylene-bridged sterically hindered phenols such as 4,4-methylenebis(6-tert-butyl-o-cresol), 4,4-methylenebis(2-tert-amyl-o-cresol), 2,2-methylenebis(4-methyl-6-tert-butylphenol), 4,4-methylene-bis(2,6-di-tert-butylphenol), and mixtures thereof.

[0029] Another suitable antioxidant can be a hindered, ester-substituted phenol, which can be prepared by heating a 2,6-dialkylphenol with an acrylate ester under base catalysis conditions, such as aqueous KOH.

[0030] The antioxidant can be present in the release additive composition in any effective amount, such as from about 0% to about 100%, for example from about 5% to about 90%, and as a further example from about 10% to about 50% by weight relative to the total weight of the release additive composition.

[0031] The release additive can also further comprise a viscosity index improver. In an embodiment, the viscosity

index improver is nitrogen-free. Non-limiting examples of nitrogen-free viscosity index improvers include polyacrylates obtained from the polymerization or copolymerization of at least one alkyl acrylate. Functionalized polymers can also be used. Among the common classes of such polymers can be olefin copolymers and acrylate or methacrylate copolymers. Functionalized olefin copolymers can be, for instance, terpolymers of ethylene and propylene which are grafted with an active monomer such as maleic anhydride and then derivatized with an alcohol. Derivatives of polyacrylate esters are well known as viscosity index improvers. Solid, oil-soluble polymers such as the PIB, methacrylate, polyalkylstyrene, ethylene/propylene and ethylene/propylene/1,4-hexadiene polymers, can also be used as viscosity index improvers. Nitrogen-free viscosity index improvers are known and commercially available. The viscosity index improver can be present in any effective amount, for example from about 0% to about 80%, for example from about 0% to about 40%, and as a further example from about 0% to about 25% by weight relative to the total weight of the release additive composition

[0032] The release additive composition can also include other additives such as dispersants, detergents, graphite, molybdenum disulfide, magnesium carbonate, silica, alumina, titania, magnesium oxide, calcium carbonate, lime, clay, zeolites, extreme pressure (EP) agents, wear reduction agents, seal swell agents, antifoaming agents, friction reducing agents, anti-misting agents, cloud-point depressants, pour-point depressants, mineral and/or synthetic oils mixtures thereof and combination thereof. These additives can be used alone or in combination, such as in an optional additional additive package.

[0033] Lubricant compositions, such as modern motor oils, can be made by combining a pre-formed additive package with a refined or synthetic base oil stock. A lubricant composition can comprise various different lubricant additive packages. Because lubricant additives can be easier to handle and measure in liquid form those additives which are normally solid can be dissolved in small amounts of base oil stock.

[0034] In one embodiment, there is disclosed a method for improving the drain interval of an engine oil comprising adding to a lubrication system the disclosed release additive composition.

EXAMPLES

Example 1 — Nominal 5 wt% Grafted E-P Rubber Dissolved in 300 TBN Sulfonate

[0035] Into a reaction flask equipped with a condenser, thermocouple, thermometer, gas inlet, and stirrer was added 500 gms of a 300 TBN sulfonate, H-611 manufactured by Afton Chemical (Richmond, VA). The reagent was blanketed with nitrogen. The reaction was heated to 135°C. With vigorous stirring, 25 gms of an ethylene-propylene copolymer grafted with 1.99 wt% maleic anhydride, PA-1275 manufactured by DSM for Afton Chemical, was added to the reaction. The reaction was stirred for 6 hours or until the rubber was completely dissolved. Analyticals: TBN = 294, Product exists as a semi-solid at room temperature.

Example 2 - Nominal 7.5 wt% Grafted E-P Rubber Dissolved in 300 TBN Sulfonate

[0036] Into a reaction flask equipped with a condenser, thermocouple, thermometer, gas inlet, and stirrer was added 500 gms of a 300 TBN sulfonate, H-611 manufactured by Afton Chemical (Richmond, VA). The reagent was blanketed with nitrogen. The reaction was heated to 135°C. With vigorous stirring, 37.5 gms of an ethylene-propylene copolymer grafted with 1.99 wt% maleic anhydride, PA-1275 manufactured by DSM for Afton Chemical, was added to the reaction. The reaction was stirred for 6 hours or until the rubber was completely dissolved. Analyticals: TBN = 290, Product solidified on cooling.

Example 3 - Nominal 10 wt% Grafted E-P Rubber Dissolved in 300 TBN Sulfonate

[0037] Into a reaction flask equipped with a condenser, thermocouple, thermometer, gas inlet, and stirrer was added 500 gms of a 300 TBN sulfonate, H-611 manufactured by Afton Chemical (Richmond, VA). The reagent was blanketed with nitrogen. The reaction was heated to 135°C. With vigorous stirring, 50 gms of an ethylene-propylene copolymer grafted with 1.99 wt% maleic anhydride, PA-1275 manufactured by DSM for Afton Chemical, was added to the reaction. The reaction was stirred for 6 hours or until the rubber was completely dissolved. Analyticals: TBN = 284, Product solidified on cooling.

Example 4

[0038] The disclosed release additive composition can be added to an oil filter located in a truck having an engine chosen from a manufacturer in Table 1. The release additive composition can extend the drain interval beyond the typical fleet drain interval, such as beyond about 15,000 miles for Detroit Diesel and International, and for example beyond

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about 25,000 miles for Caterpillar, Mack, and Volvo, and as a further example beyond about 35,000 miles for Cummins. The engine drain interval can be extended to at least about 50,000 miles, for example at least about 75,000, and as a further example at least about 100,000.

Table 1.

<u>Engine Manufacturer</u>	<u>Typical Fleet Drain Interval *</u>
Caterpillar	25,000 Miles
Cummins	35,000 Miles
Detroit Diesel	15,000 Miles
International	15,000 Miles
Mack	25,000 Miles
Volvo	25,000 Miles
* HDD Engine Manufacturers base oil drain intervals on fuel consumption, load factors, and other parameters and typically tier service intervals to fleet duty cycle. Used oil analysis may be used to extend oil drain intervals. Intervals provided are typical of North American on-highway trucking fleets.	

Example 5

[0039] The disclosed release additive composition can be added to an oil filter located in a passenger car having an engine chosen from a manufacturer in Table 2. The release additive composition can extend the drain interval beyond the typical fleet drain interval, such as beyond about 5,000 miles for Ford/Lincoln/Mercury/Ford Trucks, and for example beyond about 7,500 miles for Acura and other manufacturers, and as a further example beyond about 10,000 miles for Audi, Jaguar, Saab, and Volkswagen. The engine drain interval can be extended to at least about 25,000 miles, for example at least about 35,000, and as a further example at least about 50,000.

Table 2.

<u>Vehicle Manufacturer</u>	<u>Normal Service *</u>	<u>Severe Service *</u>
Acura	7,500 Miles / 12 Months	3,750 Miles / 6 Months
Audi	10,000 Miles	5,000 Miles
BMW	Use Service Indicator	Use Service Indicator
Chrysler/Dodge/Dodge Trucks/Jeep	6,000 Miles / 6 Months	3,000 Miles / 3 Months
Ford/Lincoln/Mercury/Ford Trucks	5,000 Miles	3,000 Miles
General Motors	7,500 Miles	3,000 Miles
Honda	7,500 Miles / 12 Months	3,750 Miles / 6 Months
Hyundai	7,500 Miles / 6 Months	3,000 Miles / 3 Months
Infiniti	7,500 Miles / 6 Months	3,750 Miles / 3 Months
Isuzu	7,500 Miles / 12 Months	3,000 Miles / 6 Months
Jaguar	10,000 Miles	10,000 Miles
Kia	7,500 Miles / 7.5 Months	5,000 Miles / 5 Months
Lexus	7,500 Miles	5,000 Miles
Mazda	7,500 Miles	5,000 Miles
Mitsubishi	7,500 Miles / 12 Months	3,000 Miles / 6 Months

(continued)

<u>Vehicle Manufacturer</u>	<u>Normal Service *</u>	<u>Severe Service *</u>
Nissan	7,500 Miles / 6 Months	3,750 Miles / 3 Months
Porsche	12,000 Miles	12,000 Miles
Saab	10,000 Miles	10,000 Miles
Subaru	7,500 Miles / 12 Months	3,750 Miles / 3 Months
Suzuki	7,500 Miles	3,000 Miles
Toyota	7,500 Miles	5,000 Miles
Volkswagen	10,000 Miles	5,000 Miles
Volvo	7,500 Miles	7,500 Miles
* Source: 2004 Chek-Chart Car Care Guide. Typical engine oil drain intervals for most models and exceptions do exist for select models from each manufacturer.		

[0040] For the purposes of this specification and appended claims, unless otherwise indicated, all numbers expressing quantities, percentages or proportions, and other numerical values used in the specification and claims, are to be understood as being modified in all instances by the term "about." Accordingly, unless indicated to the contrary, the numerical parameters set forth in the following specification and attached claims are approximations that can vary depending upon the desired properties sought to be obtained by the present disclosure. At the very least, and not as an attempt to limit the application of the doctrine of equivalents to the scope of the claims, each numerical parameter should at least be construed in light of the number of reported significant digits and by applying ordinary rounding techniques.

[0041] It is noted that, as used in this specification and the appended claims, the singular forms "a," "an," and "the," include plural referents unless expressly and unequivocally limited to one referent. Thus, for example, reference to "an antioxidant" includes two or more different antioxidants. As used herein, the term "include" and its grammatical variants are intended to be non-limiting, such that recitation of items in a list is not to the exclusion of other like items that can be substituted or added to the listed items.

[0042] While particular embodiments have been described, alternatives, modifications, variations, improvements, and substantial equivalents that are or can be presently unforeseen can arise to applicants or others skilled in the art. Accordingly, the appended claims as filed and as they can be amended are intended to embrace all such alternatives, modifications variations, improvements, and substantial equivalents.

Claims

1. A release additive composition comprising at least one overbased detergent present in a form chosen from a solid and a semi-solid.
2. A composition according to claim 1, wherein the overbased detergent is a solid.
3. A composition according to claim 1, wherein the overbased detergent is a semi-solid.
4. A composition according to any one of claims 1 to 3, wherein the overbased detergent is selected from the group consisting of sulfonates, phenates, salicylates, carboxylates, magnesium, barium, strontium, sodium, calcium, potassium and combinations thereof.
5. A composition according to any one of claims 1 to 4, wherein the overbased detergent further comprises an olefinic copolymer or a grafted olefinic copolymer viscosity index improver.
6. A composition according to any one of claims 1 to 5, further comprising a viscosity index improver.
7. A composition according to claim 6, wherein the viscosity index improver is a semi-solid.

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8. A composition according to either claim 6 or claim 7, wherein the viscosity index improver is nitrogen-free.
9. A composition according to any one of claims 6 to 8, wherein the viscosity index improver is a polyacrylate.
- 5 10. A composition according to any one of claims 1 to 9, further comprising an antioxidant.
11. A composition according to claim 10, wherein the antioxidant is a semi-solid.
12. A composition according to either claim 10 or claim 11, wherein the antioxidant is an alkyl-substituted phenol.
- 10 13. A lubricant composition comprising:
- a major amount of a base oil; and
- a minor amount of a release additive composition according to any one of claims 1 to 12.
- 15 14. A lubricant composition according to claim 13, wherein the base oil is selected from the group consisting of mineral oils, vegetable oils, paraffinic oils, naphthenic oils, aromatic oils, synthetic oils, derivatives thereof, and mixtures thereof.
- 20 15. A lubrication system comprising at least one release additive composition according to any one of claims 1 to 12 located in at least one of a filter, drain pan, oil bypass loop, canister, housing, reservoir, pockets of a filter, canister in a filter, mesh in a filter, canister in a bypass system and mesh in a bypass system.
- 25 16. A system according to claim 15, wherein the release additive composition is located in the filter.
17. A system according to either claim 15 or claim 16, wherein the filter comprises at least one pocket, and wherein each of the at least one pocket comprises the at least one release additive composition.
- 30 18. A system according to claim 17, wherein each of the at least one pocket comprises a different at least one release additive composition.
19. Use of a release additive composition as defined in any one of claims 1 to 12 for improving the drain interval of engine oil.

REFERENCES CITED IN THE DESCRIPTION

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